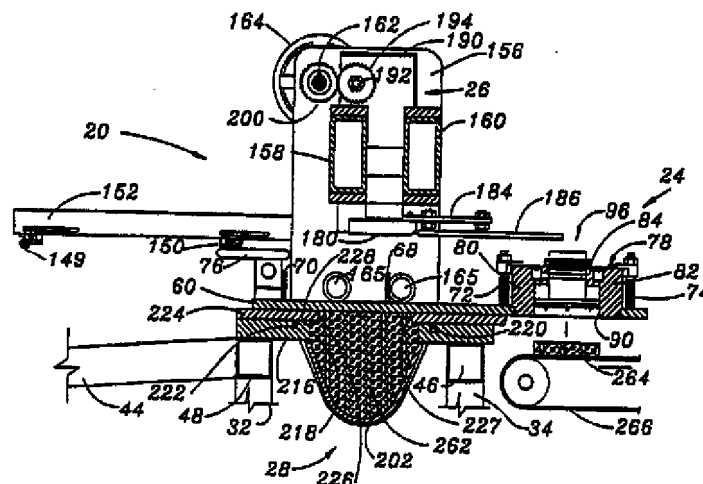




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 5 : A22C 7/00		A1	(11) International Publication Number: WO 91/01644
			(43) International Publication Date: 21 February 1991 (21.02.91)
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(22) International Filing Date: 4 May 1990 (04.05.90)			
(30) Priority data: 392,075 10 August 1989 (10.08.89) US		(81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CM (OAPI patent), DE*, DE (European patent)*, DK (European patent), ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL, NL (European patent), NO, RO, SD, SE, SE (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent).	
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(54) Title: SLIDE PLATE PATTY FORMING APPARATUS



(57) Abstract

An improved, slide plate-type patty forming apparatus (20) is provided which preferably includes a reciprocating slide plate (60) with a removable, multiple piston and cavity head (78) adapted to move between a retracted meat-filling position wherein respective patty forming cavities (90) are filled with meat to an extended patty-discharging position wherein formed meat patties (264) are ejected. Each of the patty forming pistons (96) is equipped with a porous bottom plate (104) formed of sintered metal or ceramic, an appropriate compressed air passageways (120, 122, 106) are provided for delivery of air through the bottom plate (104) for cleanly ejecting the formed patty (264). Adjusting mechanism (26) for altering the thickness of formed patties (264) includes a plurality of adjusting units (166) each equipped with a vertically shiftable, piston-engaging foot (176); movement of the feet (176) in unison is effected by means of handwheel (164) and connecting gear train (162, 200, 194, 192, 174). Individual variance of respective patty forming stations can also be accomplished by gear disengagement and manual adjustment.

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-1-

1 SLIDE PLATE PATTY FORMING APPARATUS

Background of the Invention

5 1. Field of the Invention

 The present invention is broadly concerned with an improved, high-capacity patty forming apparatus adapted for use in the commercial production of meat patties formed of, e.g., chicken, beef or pork. More particularly, it is concerned with
10 such an apparatus which in preferred forms includes a reciprocating slide plate equipped with a removable, multiple piston and cavity head adapted to receive and form patties, and with piston-adjusting mechanism permitting both individual and ganged
15 adjustment of patty thickness without the necessity of piston removal; moreover, the preferred apparatus includes pistons having porous meat-engaging faces together with structure for delivering bursts of
20 pressurized air through the piston faces in order to positively disengage the formed patties from the respective cavities.

 2. Description of the Prior Art

25 Large food processors supplying meat patties to restaurants and fast food chains make use of industrial sized patty forming equipment. Obviously, such equipment is essential in order to economically produce the huge quantities of meat
30 patties needed to meet customer demand.

 One type of known patty forming device is described in U.S. Patent No. Re. 30,096. This machine, known as a "Formax" patty former, is
35 characterized by an apertured slide plate which is shiftable between a retracted position wherein meat

-2-

1 is received within the patty forming apertures
thereof, and an extended position wherein the formed
patties are ejected from the slide plate. For this
purpose, the machine is equipped with a stationary
5 ejector device located at the patty discharge posi-
tion and provided with multiple, up and down recip-
rocal patty knock-outs.

While slide plate devices of this type
have achieved a measure of use in the industry, a
10 number of problems remain. First, the output capa-
city of these machines is normally limited to a
maximum of no more than 4,000 pounds of meat per
hour, or 80 cycles of the patty forming mechanism
per minute, whichever is achieved first. This
15 capacity is significantly lower than the require-
ments of many present-day patty forming operations.

In addition, slide plate formers of the
type disclosed in the referenced patent require that
20 the slide plate be changed in order to alter the
thickness or size of the patties being formed. Such
a changeover operation entails considerable effort
and down time, and is therefore costly.

Finally, many users of Formax machines
25 have experienced considerable problems and expense
by virtue of the need for rather frequent parts
replacement. This problem is believed to be par-
tially due to the use of fixed position patty
knock-outs as described above, which can become
30 misaligned with the slide plate apertures and,
during high speed operations, induce extreme machine
vibrations.

Another type of prior patty forming
apparatus is described in U.S. Patent No. 4,193,167.
35 This type of machine employs a rotatable turret

-3-

1 plate equipped with a series of spaced patty forming
cavities, each of the latter including a shiftable
piston therein. Up and down movement of the pistons
is controlled via an overhead cam arrangement, so
5 that, as the turret rotates, the meat is first
delivered to individual cavities and thereafter
deposited in patty form on a belt or the like.

Turret machines suffer from many of the
problems of prior slide plate devices, particularly
10 low output (typically, such machines can produce
patties only one at a time as the turret rotates).
Furthermore, such machines are particularly diffi-
cult to adjust so that all patties produced by the
respective cavity/piston assemblies are of uniform
15 size and weight. That is to say, with such turret
machines, it is virtually impossible to individually
adjust the respective pistons so as to give pre-
cisely even patty weights from all cavities.

20 In order to insure patty discharge from
the turret cavities, use is made of a continuous
moving cut-off band located adjacent the patty
discharge position and designed to strip the patties
from the individual pistons. Expedients such as
25 these have proved to be troublesome in that meat
tends to "hang up" on the stripper and/or piston.
This leads to deformed patties, improper patty
weights, and generally unsanitary conditions.

30 Summary of the Invention

The present invention overcomes the
problems outlined above and provides a greatly
improved, high capacity patty forming device charac-
terized by ready adjustment to insure even patty
35 weights, and a unique system for positive ejection

-4-

1 of formed patties making use of porous, air permeable piston faces.

5 The preferred forming apparatus of the present invention includes a patty forming plate assembly including structure defining a plurality forming cavities with a slidable piston within each cavity which is movable between a retracted position allowing flow of patty forming material into the associated cavity, and an extended discharge position for discharge or ejection of the formed patties. The material-engaging faces of the pistons are formed of a porous material such as sintered metal, porous synthetic resin (e.g., polyethylene) or porous ceramic.

15 The apparatus further includes structure for supporting the plate assembly for shifting movement thereof between a position for receiving meat or other patty forming material into the cavities, and a spaced discharge position wherein the formed patties are discharged. Preferably, the slide plate assembly comprises an apertured, generally flat, fore and aft shiftable forming plate (moved via a pair of metal hydraulic piston and cylinder assemblies) together with a multiple cavity head secured to the plate for movement therewith.

25 In order to supply the plate assembly with patty forming material, means including an appropriately sized chamber is situated beneath the plate assembly; the chamber is adapted for coupling with a source of patty forming material under pressure, such as a twin piston food pump of the type commercialized by Marlen Research Corporation of Overland Park, Kansas. In addition, the chamber communicates with an accumulator conduit including

-5-

1 an accumulator piston therein, to even flow through
the chamber and to the patty forming cavities.

5 Selectively actuatable pneumatic apparatus is also coupled with the cavity pistons in
order to accomplish two ends, namely downward shifting
of the pistons to their discharge positions,
and, near the end of this stroke, delivery of a
burst of pressurized air or other gas through the
10 porous piston face in order to forcibly and cleanly
separate the formed patties from the piston.

Adjustment of the respective pistons
within their associated cavities is effected by
means of an adjustment mechanism situated above the
15 piston head adjacent the material-receiving position
of the slide plate. The adjusting mechanism serves
to limit the movement of the pistons within the
associated cavities, and is equipped with structure
for selectively altering the stroke length of the
20 pistons to thereby vary the thicknesses of the
patties. Very importantly, this movement-limiting
means is designed for thickness adjustment of all of
the pistons in unison, or alternately for individual
thickness adjustment of each of the pistons with
25 respect to the other pistons. In this fashion, the
patty former can be precisely adjusted to give
uniform weights and thicknesses from all cavities;
moreover, if desired, certain cavities can be ad-
justed to produce relatively thin patties, whereas
30 other pistons within the head may be adjusted for
relatively thicker patties. In addition, such
adjustment may be effected without removal of the
pistons from their associated cavities, or replacement
of the reciprocal slide plate. Furthermore,
35 adjustment in unison of the pistons can safely be

-6-

1 made without stopping the operation of the patty
former.

5 The preferred patty forming apparatus is
also equipped with a unique sealing arrangement
provided between the material-conveying chamber and
the slide plate assembly. Specifically, the chamber
is provided with an apertured, generally horizon-
tally extending, top plate having a sealing groove
extending circumferentially about the top plate
10 aperture. A deflectable, intermediate shearing
plate formed of resilient synthetic resin material
such as nylon is positioned in overlying relation-
ship to the top plate, and likewise has an aperture
15 in general alignment with the top plate aperture.
However, the shearing plate aperture is smaller than
that of the top plate, such that the shearing plate
presents an inwardly extending lip region extending
about the periphery of the top plate aperture.
20 Finally, the slide plate assembly is positioned atop
the shearing plate and is shiftable relative to both
the shearing plate and the top plate.

 In operation, material under positive
pressure fed to the material-conveying chamber
25 beneath the slide plate assembly engages the afore-
mentioned lip region of the shearing plate and
deflects the latter into positive sealing engagement
with the slide plate assembly. At the same time, a
fluid pressure actuatable sealing member is situated
30 within the top plate groove and can be selectively
operated to extend upwardly into sealing engagement
with the shearing plate.

35

-7-

1 Brief Description of the Drawings

FIG. 1 is a side elevational view of the preferred patty forming apparatus of the invention;

5 FIG. 2 is a fragmentary end view with parts broken away for clarity and depicting the discharge end of the apparatus;

FIG. 3 is a view similar to that of FIG. 2, but depicting the opposite end of the apparatus;

10 FIG. 4 is a fragmentary view in partial vertical section of the patty forming apparatus shown with the slide plate assembly thereof in its material-receiving position;

15 FIG. 5 is a view similar to that of FIG. 4, but illustrating the slide plate assembly shifted rightwardly from the material-receiving position;

FIG. 6 is a view similar to that of FIGS. 4-5, but depicting the slide plate assembly in its patty-discharging position;

20 FIG. 7 is a view similar to that of FIG. 6, and illustrating the patty discharging operation of the slide plate assembly;

FIG. 8 is a plan view of the preferred patty forming apparatus;

25 FIG. 9 is a top view of the patty forming apparatus, in partial section and with parts broken away for clarity;

30 FIG. 10 is an enlarged vertical sectional view illustrating the details of the patty forming head and thickness adjustment mechanism;

35 FIG. 11 is a vertical sectional view of the patty forming apparatus, with certain parts removed for clarity, illustrating the head and adjustment mechanism apparatus;

-8-

1 FIG. 12 is a schematic representation of
the hydraulic cushioning mechanism associated with
the piston and cylinder assemblies employed for
reciprocation of the slide plate assembly;

5 FIG. 13, is an enlarged elevational view
of a patty forming piston used in the overall appa-
ratus; and

10 FIG. 14 is a bottom view of the piston
depicted in FIG. 13, with parts broken away.

Description of the Preferred Embodiment

Turning now to the drawings, and par-
ticularly FIG. 1, patty forming apparatus 20 broadly
15 includes a lower frame 22, slide plate assembly 24,
adjustment mechanism 26, and a material feeding
assembly 28.

In more detail, the frame assembly 22
includes spaced pairs of uprights 30-34 together
20 with spaced pairs of crosspieces 36-44 and upper
cross beams 46-48 (see FIGS. 2-3) which are inter-
connected with the uprights to form a free-standing
three-dimensional frame. As illustrated, the appa-
ratus components 24, 26 and 28 are supported on the
25 frame structure adjacent the upper end thereof. The
lower frame beneath the patty forming components
supports an electric motor 50 operatively connected
with hydraulic pump 52; and three compressed air
tanks 54-58.

30 Slide plate assembly 24 includes an
elongated, generally flat, planar slide plate 60
presenting a rearward edge 62, forward edge 64 and a
large, substantially rectangular aperture 66 there-
through which is proximal to the forward edge 64.
35 The plate has a pair of upstanding, transverse

-9-

1 stiffening ribs 68, 70, as well as a pair of upright
head connection plates 72, 74 adjacent to and in
straddling relationship to aperture 66. An upstand-
ing contact bar 76 is secured to the righthand
5 margin of plate 60 adjacent rearward edge 62 thereof
as best seen in FIG. 8.

The assembly 24 further includes a head
assembly broadly referred to by the numeral 78. The
head assembly has a rectangular, box-like frame
10 presenting a pair of upright sidewalls 80, 82, top
wall 84 and opposed end walls 86, 88. As best seen
in FIGS. 8 and 10, the head is configured to present
a plurality, here five, of patty forming cavities 90
15 along the length thereof between end wall 86, 88.
Each cavity includes an enlarged lower region 92
together with a radially constricted upper region
94. A shiftable piston 96 is slidably positioned
within each cavity 90, and includes a lowermost
20 enlarged section 98 situated within region 92 of the
associated cavity, as well as an upstanding section
100 which extends through and above the radially
constricted region 94 of the cavity.

Referring specifically to FIG. 10, it
25 will be seen that each piston 96 is provided with a
peripheral ring 102 disposed about the lower peri-
phery of the section 98 and secured thereto by set
screws 103; the ring 102 is coupled to and supports
a porous, sintered metal or ceramic faceplate 104
30 which defines the lowermost materialengaging face of
the overall piston. Preferably, the faceplate 104
is formed of sintered material having an average
pore diameter of from 2 to about 15 microns (most
preferably about 5 microns), while the adjacent
35 surface of piston section 98 is provided with a

-10-

1 plurality of interconnected, radially and circum-
ferentially extending air passageways 105 (see FIG.
14).

5 The body of piston 96 is also provided
with a pneumatic passageway 106 of inverted, some-
what L-shaped configuration which communicates with
the inner surface of faceplate 104 and particularly
the passageways 105 provided therein. The section
10 100 of piston 96 has a two piece, segmented stop
ring 108 secured thereto, which is affixed by means
of circumscribing O-ring 110. Additional sealing of
the piston within the associated cavity is provided
by means of O-ring 112 and 114 respectively located
15 within appropriate grooves in section 98 and top
wall 84.

In order to effect downward discharge
movement of the piston 96, the head assembly in-
cludes a transversely extending air passageway or
20 manifold 116 which extends the full length of the
head assembly. A short vertical air passageway 118
is also provided for each piston which communicates
passageway 116 with the face of the enlarged piston
section 98 remote from faceplate 104. Additionally,
25 a second transversely extending passageway or mani-
fold 120 is also provided, with short, radially
inwardly extending air passageway 122 for each
piston which communicates the passageway 120 and
passageway 106 when the piston is in its lowered,
30 partly discharging position. A pneumatic fitting is
provided for delivery of pressureized air to the
passageway 120, and another such fitting (both not
shown) communicates with passageway 116 for delivery
of pressurized air thereto.
35

-11-

1 As illustrated in FIG. 10, the head
assembly 78 is affixed to slide plate 60 and is in
registry with the plate aperture 66. To this end, a
5 series of threaded connectors 126 are secured to the
plates 72, 74 and include projecting tabs which
engage the top wall 84 of the head section. The
lower margin of each sidewall 80, 82 is notched as
at 128 so as to receive and rest atop the adjacent
10 portions of plate 60; a continuous seal 130 between
the plate 60 and defining walls of the head assembly
completes the connection.

 Although the pistons depicted in the
drawings are hexagonal in configuration, those
15 skilled in the art will appreciate that virtually
any shaped piston can be provided such as circular,
square, oval or free form.

 Slide plate assembly 24 reciprocates
during operation of apparatus 20. For this purpose,
20 a pair of piston and cylinder assemblies 132, 134
are provided, each including a hydraulic cylinder,
internal piston 132a, 134a, and projecting piston
rod 136, 138. As best seen in FIG. 8, the assem-
blies 132, 134 are located on opposite sides of
25 plate 60, and are mounted on the sidewalls 154, 156
by means of upstanding mounts 139. The extensible
rods 136, 138 are each coupled via quick connect
pins 140, 142 to connection brackets 144, 146 re-
spectively secured to slide plate 60. Therefore,
30 extension and retraction of the rods 136, 138 pro-
duces corresponding reciprocation of slide plate 60.

 The slide plate assembly reciprocates
between respective limits defined by limit switches
148, 150 which are supported in spaced relationship
35 on stationary beam 152. As will be appreciated from

-12-

1 a study of FIGS. 4-7, the contact bar 76 affixed to
slide plate 60 is oriented for engaging the limit
switches 148, 150 during travel of the plate.

5 Adjusting mechanism 26 is situated above
slide plate assembly 24 and includes a pair of
upright laterally spaced apart sidewalls 154, 156
supported by frame 22. The sidewalls 154, 156 in
turn support a pair of transversely extending spaced
10 apart support beams 158, 160, as well as an elongated,
axially rotatable keyed shaft 162, the latter
being equipped with a large handwheel 164 outboard
of and adjacent to sidewall 156. A pair of spaced
apart, slide plate engaging rollers 165 are rotatably
15 mounted to the innerface of each sidewall 154,
156, and are located to contact the side marginal
edges of slide plate 60 during reciprocation thereof,
in order to assist in plate guidance. Finally,
it will be seen that stationary beam 152 is fixedly
20 secured to the rearward end of sidewall 156.

The mechanism 26 further includes a total
of five laterally spaced apart adjusting units 166,
supported by the beams 158, 160 and spaced between
the sidewalls 154, 156 for engaging a corresponding
25 underlying piston 100. Each of the units 166 are
identical, and include a stationary upright tubular
guide 168 including a threaded upper end 170 and
supported by the beams 158, 160; a pair of bottom
clamping members 171 secured by bolts 171a are
30 secured to guide 168 (see FIG. 11). The guide in
turn receives a tubular, externally threaded drive
member 172 provided with an axially extending keyway
therein. The portion of member 172 above guide 168
is affixed to a keyed worm gear 174, such that
35 rotation of the worm gear effects up and down move-

-13-

1 ment of the drive member 172 along the length of the
 threaded upper end of 170 of guide 168. A depending
 foot member 176 is secured to the lower end of drive
5 member 172 by means of bolt 178 passing through
 drive member 172; the lower end of the member 176
 includes a horizontally extending segment 180. As
 best seen in FIG. 10, a forwardly extending piston-
10 engaging frame 182 is secured to the segment 180,
 and includes a pair of vertically spaced apart
 plates, 184, 186 interconnected by bolts 188. The
 lowermost plate 186 is designed to engage the upper
 surface of piston 100 as illustrated. The plates
15 186 are normally adjusted slightly upwardly (e.g.,
 20-30 thousandths of an inch) relative to the bottom,
 piston-engaging surfaces of the adjacent segments
 180, for purposes which will be explained.

 The upper end of each unit 166 includes a
 box-like housing 190 which overlies the drive member
20 172 and its associated structure. A short, trans-
 versely extending, rotatable worm shaft 192 extends
 between the sidewalls of housing 190 and is provided
 with an external drive gear 194 as well as an inter-
 nal worm 196. Again referring to FIG. 10, it will
25 be seen that the worm 196 of each unit 166 is in
 driving engagement with the corresponding worm gear
 174. A synthetic resin spacing collar 198 is situ-
 ated between the upper surface of gear 174 and the
 top wall of housing 190.

30 Keyed shaft 162 is provided with a total
 of five gears 200 spaced along the length thereof
 and respectively in mesh with a corresponding drive
 gear 194. Accordingly, rotation of handwheel 164
 serves to raise and lower the piston-engaging frame
35 182 for purposes which will be described.

-14-

1 The material feeding assembly 28 includes
a large, arcuate, open top chamber 202 which extends
laterally the width of apparatus 20. A tubular
coupler 204 is affixed to one end of chamber 202 and
5 is adapted for connection to a food pump 206 through
appropriate conduits or the like (not shown). Preferably, a positive pressure, twin piston food pump commercialized by Marlen Research Corporation of Overland Park, Kansas is employed. The opposite end
10 of chamber 202 is secured to a coupler 204 and an accumulator conduit 208 provided with a pair of spaced pneumatic sensing ports 210, 212 and an end plate 213 equipped with a compressed air port 213a.
15 An accumulator piston 214 having terminal, circumscribing seals 214a, is situated within conduit 208 and is shiftable therewithin. A charge of compressed air is maintained between end plate 213 and the adjacent face of piston 214, for purposes to be
20 described.

 The chamber 202 is supported by a metallic top plate 216 presenting a relatively large, rectangular aperture 218 therethrough in registry with the open top of the chamber. Top plate 216 is
25 rigidly supported on cross beams 46, 48 as illustrated in FIGS. 4-7. The upper surface of plate 216 is provided with a continuous, circumscribing, seal-receiving groove 220 extending about the aperture 218. A flexible seal 222 is situated within groove
30 220, and is a known type of seal which is flexible and deflectable upwardly under the influence of fluid pressure exerted by means of conventional apparatus (not shown).

35 A synthetic resin (e.g., nylon) shearing plate 224 is positioned atop plate 216 and is pro-

-15-

1 vided with a rectangular aperture 226 therethrough
in general registry with aperture 218 and presenting
a beveled, forward edge 227. Aperture 226 is small-
er than aperture 218, so as to present an inwardly
5 extending, deflectable lip region 228 about the
periphery of aperture 218. Slide plate 60 forming a
part of assembly 24 contacts shearing plate 224 and
is moveable relative thereto.

10 Turning now to FIG. 12, the cushioning
apparatus for the mated piston and cylinder assem-
blies 132, 134 is schematically illustrated. Each
of the identical assemblies 132, 134 is of the
double-acting variety and includes, as a part of its
15 internal piston, a pair of oppositely extending
frustoconical extensions 226, 228. As illustrated,
the piston rods 136, 138, are coupled with and
extend from the corresponding extensions 228. In
addition, the surrounding hydraulic cylinder of each
20 assembly includes endmost tubular bushings 230, 232
designed to coact with the piston extension 226, 228
in the manner to be described. In this regard, it
will be seen that piston rod 136 extends through the
associated bushing 232 and out of the surrounding
25 hydraulic cylinder.

Each cylinder further includes a pair of
primary hydraulic ports 234, 236, together with
secondary ports 238, 240 adjacent the respective
bushings 230, 232. The primary ports 234, 236 are
30 respectively in communication with the interior
regions of the bushings 230, 232, whereas the sec-
ondary ports 238, 240 communicate exteriorly of
these two regions. Primary hydraulic lines 242, 244
extend from the hydraulic system associated with
35 pump 52 to the ports 234, 236. On the other hand,

-16-

1 transverse hydraulic lines 246, 248 interconnect the
secondary ports 238, 240 of the mated assemblies
132, 134. A pair of variable resistance flow re-
5 stricting devices 250, 252 are also provided, each
including a one way check valve 254, 256, as well as
a restricted orifice 258, 260. Device 250 is couple
between primary hydraulic line 242 connected to
assembly 132, and to transverse hydraulic line 246
10 as illustrated; similarly, device 252 is connected
between primary hydraulic 244 couple with assembly
132, and transverse hydraulic line 248.

Attention is next directed to FIGS. 4-6
which depict the operation of apparatus 20. FIG. 4
15 illustrates the slide plate assembly 24 in its
retracted position wherein the cavities 90 are in
registry with aligned apertures 218, 226, and there-
by in communication with chamber 202. The latter is
filled with meat 262 under positive pressure, such
20 being provided by virtue of operation of meat pump
206. As a consequence, the meat 262 is fed upwardly
into the cavities 90 so that the pistons are elevat-
ed until the upper ends thereof engage the overlying
segments 180. At this point, the cavities 90 are
25 filled to capacity. Displacement of air from the
cavities 90 is accomplished by passage of such air
upwardly through the porous faceplates 104, and
passageways 105, 106 to the atmosphere. In this
fashion, the undesirable buildup of air within the
30 cavities 90 is completely illminated.

Slide plate 60 is next moved rightwardly
as viewed in FIG. 5 so as to move head assembly 78
out of communication with chamber 202 to complete
the formation of meat patties 264 within the respec-
35 tive cavities. As illustrated in FIG. 5, the

-17-

1 bottom surfaces of the patties 264 slide along
synthetic resin shearing plate 224; clean patty
formation is assured by virtue of beveled edge 227
forming a part of the aperture 226. Note also that
5 piston height is maintained by means of engagement
between pistons 96 and the overlying plates 186. As
explained previously, the plates 186 are positioned
slightly above the adjacent surfaces of the segments
10 180 so that, as the pistons move out of engagement
with the segments 180 and into engagement with the
plates 186, the internal pressure of the meat within
the cavities 90 is relieved. This prevents unwanted,
premature ejection or "squirting" of meat from
15 the cavities 90 as the cavities clear the forward
edge of plate 224 during movement of slide plate 60
to the patty discharge position depicted in FIG. 6.

FIG. 6 depicts the orientation of apparatus 20 with slide plate assembly 24 in its forward
20 most position where assembly 78 has completely
cleared shearing plate 224. At this point, the
pistons 96 of head assembly 78 are pneumatically
actuated so as to eject the formed patties 264 from
the respective cavities 90. Referring to FIG. 10,
25 it will be seen that application of compressed air
through manifold 116 and in timed relationship with
the movement of head 78, effects downward shifting
movement of the pistons 96. Specifically, compressed
air delivered through the manifold 116 is directed
30 through passageways 118 so that such air encounters
the upper annular faces of piston sections 98,
to forcibly drive the pistons downwardly. At the
downward end of the piston stroke where the piston
stop rings 108 engage top wall 84, the pneumatic
35 passageways 106 forming a part of the pistons 96

-18-

1 comes into operative communication with the associ-
ated, horizontally extending passageways 122 con-
nected with manifold 120. Compressed air is deliv-
5 ered to the latter in properly timed relationship so
as to deliver such air through the passageways 122,
106 and ultimately to the surfaces of faceplates 104
remote from patties 264. Such air is then directed
via passageways 105 to all portions of the porous
10 faceplates, so that pressurized air is delivered to
the faceplates 104 in order to quickly and cleanly
eject the formed patties 264. As best seen in FIG.
7, a conventional belt conveyor 266 or other expedi-
ent is situated below the slide plate assembly 24 so
15 as to catch the ejected patties and convey them for
further processing.

After patty ejection, the assembly 24 is
in position for retraction back to the FIG. 4 ori-
entation, so as to repeat the patty forming cycle.
20 Preferably, the pistons 96 are positioned with the
bottom faceplates thereof slightly above the lower
defining margins of the associated cavities 90. Any
entrapped air below the faceplates as the slide
plate 60 retracts is vented to the atmosphere
25 through the porous faceplates and the passageways
105, 106. This venting capability also permits use
of transversely arcuate or otherwise irregularly
shaped cavities within head assembly 78, to thereby
allow formation of correspondingly shaped patties.
30 Heretofore, it has been difficult to form such
patties because of the tendency of prior patty
forming machines to entrap air within the cavities
prior to filling thereof.

During the described patty forming opera-
35 tions of apparatus 20, the accumulator conduit 208

-19-

1 and slidable accumulator 214 come into play. In
this regard, it is preferred to employ a food pump
206 (such as the Marlen pump previously described)
equipped with pneumatic operational controls.
5 Appropriate pneumatic lines (not shown) are con-
nected between the conventional pump controls and
the ports 210, 212 forming a part of accumulator
conduit 208. Such a pump/accumulator arrangement is
specifically disclosed and explained in U.S. Patent
10 No. 4,780,931, which is incorporated by reference
herein. In any event, excess meat fed to chamber
202 is collected within conduit 208, which has the
effect of shifting piston 214 rightwardly as viewed
15 in FIG. 11 against the bias exerted by the charge of
compressed air between piston 214 and end plate 213.
Such accumulation of meat continues until piston 214
is moved to a position covering port 212. This
piston movement is sensed and an appropriate pneu-
20 matic signal is sent to pump 206 in order to slow
down or stop the pump as required. Continued action
of the apparatus 20, serving to deplete the supply
of meat within chamber 202, allows meat accumulated
within conduit 208 to be fed back to chamber 202,
25 such action being accomplished by virtue of the bias
against piston 214 from the charge of compressed air
within the conduit. Of course, if piston 214 moves
leftwardly to the point where port 210 is open, a
pneumatic signal is sent to pump 206 in order to
30 increase its output.

If it is desired to alter the thickness
of the patties 264 being formed, the operator has
two options. If a thickness change in all patties
is desired, it is only necessary to grasp handwheel
35 164 and rotate shaft 162 in the desired direction.

-20-

1 Such rotation serves, via gears 200, 194, shafts
192, worms 196 and worm gears 174, to appropriately
raise or lower the foot members 176 and connected
plates 184, 186. As best illustrated in FIG. 10,
5 such rotation of shaft 162 effects vertical movement
of the drive members 172 so as to produce the desired
adjustment of the foot members and plates.

On the other hand, if it is desired to
adjust only certain of the pistons 96 insofar as
10 their stroke lengths are concerned, each adjusting
unit 166 can be individually manipulated. Specifically,
individual adjustment may be accomplished by
shifting the gear 200 associated with the unit to be
adjusted along shaft 162 until the gear 200 is moved
15 out of mesh with the cooperating gear 194. At this
point, the gear 194 may be rotated to again raise or
lower the respective foot member 176 and plates 184,
186. After such adjustment is completed, the gear
20 200 is again moved along shaft 162 until proper
meshing relationship is established with the gear
194.

During the operation of piston and cylinder
assemblies 132, 134, the cushioning apparatus
25 depicted in FIG. 12 serves to equalize and cushion
the travel of pistons 132a, 134a as the pistons
approach the ends of their strokes. Specifically,
and referring to FIG. 12, a situation is depicted
wherein the pistons 132a, 134a are moving rightward-
30 ly. During such movement, pressurized hydraulic
fluid is directed through lines 242 and ports 234
while simultaneously fluid is being exhausted
through ports 236 and lines 244. As the extension
228 approach bushings 232, however, flow of fluid
35 through the ports 236 is progressively restricted.

-21-

1 At this point, hydraulic fluid begins to exhaust
through secondary ports 240 and line 248. Such flow
is restricted by means of orifice 260 forming a part
of device 252, so that the travel of the pistons
5 132a, 134a is slowed and cushioned until the terminal ends of the travel of the pistons is reached.
This situation is reversed when the pistons travel
leftwardly as viewed in FIG. 12, wherein cushioning
is effected by exhaust flow of fluid through ports
10 238, line 246, and orifice 258. It will therefore
be appreciated that the assemblies 132, 134 operate
completely in unison with appropriate cushioning at
the ends of each piston stroke. This ensures that
15 the slide plate assembly 24 is not subjected to
torsional forces during reciprocation, and eliminates
possibly destructive shock loads at the ends
of slide plate travel.

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-22-

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Claims:

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1. Patty forming apparatus comprising:
a patty forming plate assembly including
structure defining a patty forming cavity,
and a slidable piston presenting a
patty material-engaging face formed of
porous material and movable within said
cavity between a retracted position
allowing flow of patty forming material
into said cavity for forming of a patty
therein, and an extended discharge position
for discharge of the formed patty;
means supporting said plate assembly for
reciprocating, translational, fore and
aft shifting movement thereof between a
material-receiving position and a patty-
discharging position;
means operably coupled with said plate assembly
for delivery of patty forming material to the
assembly when the assembly is in the material-
receiving position thereof, in order to fill
said cavity and form said patty therein;
means for shifting said piston to the discharge
position thereof when said assembly is in
said patty-discharging position; and
means for forcibly separating said patty from
said piston face when the piston is in
said patty-discharging position thereof,
said patty-separating means including means
for applying a burst of pressurized fluid

-23-

1 through said piston face to separate said
patty therefrom.

5 2. The apparatus as set forth in claim
1, including means for limiting the movement of said
piston within said cavity when said plate assembly
is in the material-receiving position thereof, said
movement-limiting means including structure for
10 selectively altering the stroke length of said
piston in said cavity in order to vary the thickness
of the patty formed in said cavity.

15 3. The apparatus as set forth in claim
2, said movement-limiting means being disposed above
said piston and oriented for engagement by the
piston when the assembly is in the material-receiv-
ing position thereof, there being structure for
selective up and down adjustment of said movement-
limiting means.

20 4. The apparatus as set forth in claim
1, said material-delivery means including a mater-
ial-holding chamber beneath said plate assembly,
means for operably coupling said chamber to a source
25 of material under pressure, and accumulator appara-
tus in communication with said chamber.

30 5. The apparatus as set forth in claim
4, said cavity being located between said chamber-
coupling means and said accumulator apparatus, said
accumulator apparatus including an elongated con-
duit, with accumulator piston means slidably receiv-
ed within said conduit.

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-24-

1 6. The apparatus as set forth in claim
1, said plate-supporting means comprising hydraulic
piston and cylinder drive means operably coupled to
said plate assembly.

5

7. The apparatus as set forth in claim
1, said piston shifting means comprising structure
for selective application of fluid pressure against
said piston for shifting of the latter to the piston
discharge position.

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8. The apparatus as set forth in claim
1, said patty material-engaging face of said piston
being formed of sintered metal or porous synthetic
resin or ceramic material.

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9. The apparatus as set forth in claim
8, said patty material-engaging face being formed of
sintered metal having an average pore size of from
about 2 to 15 microns in diameter.

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10. The apparatus as set forth in Claim
1, including structure operably coupled with said
delivery means for delivery of said material to said
assembly under positive pressure.

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-25-

1 11. The apparatus as set forth in Claim
2 1, there being structure for communicating said
3 porous patty material-engaging face with the atmo-
4 sphere.

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6 12. Patty forming apparatus comprising:
7 an apertured, generally flat forming plate;
8 a patty forming head secured to said plate and
9 in registry with the aperture there-
10 through, said head including structure
11 defining a plurality of spaced, individ-
12 ual cavities, and a like plurality of
13 slidable pistons respectively moveable
14 within each of said cavities between
15 retracted positions allowing flow patty
16 forming material into corresponding
17 cavities for formation of patties there-
18 in, and extended discharge positions for
19 discharge of formed patties from said
20 cavities;
21 means supporting said plate for translational
22 shifting movement of the plate and head
23 between a material-receiving position and
24 a spaced patty-discharge position;
25 means operably coupled with said plate and in
26 communication with said aperture for
27 delivery of material to said cavities
28 when said plate is in said material-
29 receiving position thereof, in order to
30 fill said cavities and form said patties
31 therein;
32 means for shifting said pistons to the dis-
33 charge positions thereof when said plate
34 is in said discharge position.

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-26-

1 is in the patty-discharging position
 thereof; and
 means for limiting the movement of said pis-
 tons within corresponding cavities when
5 said plate is in said materialreceiving
 position thereof in order to vary the
 thickness of patties formed in said
 cavities,
10 said movement-limiting means including a sepa-
 rate piston-engaging unit disposed above
 each corresponding piston,
 there being structure operably coupled with
 said units for selective up and down
15 adjusting movement thereof in unison, and
 for individual up and down adjusting
 movement of each of said units with re-
 spect to the other units.

20 13. In a patty forming apparatus includ-
 ing a shiftable patty forming plate assembly having
 a plurality of patty forming cavities therein, a
 shiftable piston situated within each cavity, means
 operably coupled with said plate assembly for de-
25 livery of patty forming material to said cavities
 for formation of patties therein, and means for
 subsequently shifting said pistons for ejecting
 formed patties from said cavities, the improvement
 which comprises patty thickness adjusting means
30 operably coupled with said pistons for varying the
 thickness of patties formed in said cavities said
 adjusting means including structure for thickness
 adjustment of all of said pistons in unison, and for
 individual thickness adjustment of each of said
35 pistons with respect to the other pistons.

-27-

1 14. Patty forming apparatus as set forth
in Claim 13, said thickness adjusting means a sepa-
rate piston-engaging unit disposed above each cor-
responding piston and oriented for engagement by the
5 corresponding piston during delivery of patty form-
ing material to said cavities, there being structure
operably coupled with all of said units for selec-
tive up and down adjusting movement thereof in
unison, and for individual up and down adjusting
10 movement of each of said units with respect to the
other units.

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-28-

1 15. In patty forming apparatus including
a shiftable patty forming plate assembly having
structure defining a patty forming cavity therein,
means for delivery of patty forming material to said
5 cavity for formation of a patty therein, and means
for subsequently ejecting said formed patty from
said cavity, the improved material-delivery means
which comprises:

10 a material-conveying chamber beneath said
assembly and presenting an apertured top
plate;
a deflectable, apertured shearing plate above
said top plate,
15 the apertures of said top plate and shearing
plate being in general alignment, with
said shearing plate aperture being smaller
than said top plate aperture to present an
inwardly extending lip region which is a
20 part of said shearing plate and which
extends about the periphery of said top
plate aperture,
said patty forming plate assembly being shift-
able relative to said top plate and shear-
25 ing plate and being proximal to the lat-
ter; and
means for coupling said chamber to a pumping
device for delivery of patty forming
material under positive pressure to said
30 chamber, in order to cause said material
under positive pressure to engage said lip
region and deflect said shearing plate
into sealing engagement with said shift-
able patty forming assembly.
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-29-

1 16. The patty forming apparatus of Claim
15, including structure defining a seal-receiving
5 groove in the face of said top plate adjacent said
 shearing plate, said groove circumscribing said top
 plate aperture, and a resilient, fluid pressure
 actuatable sealing member within said groove and
 adapted to sealingly engage said shearing plate.

10 17. The patty forming apparatus of Claim
15, said patty forming plate assembly including a
 generally flat, apertured forming plate, and means
 for selective, translational, fore and aft shifting
15 movement of the plate relative to said top plate and
 said shearing plate.

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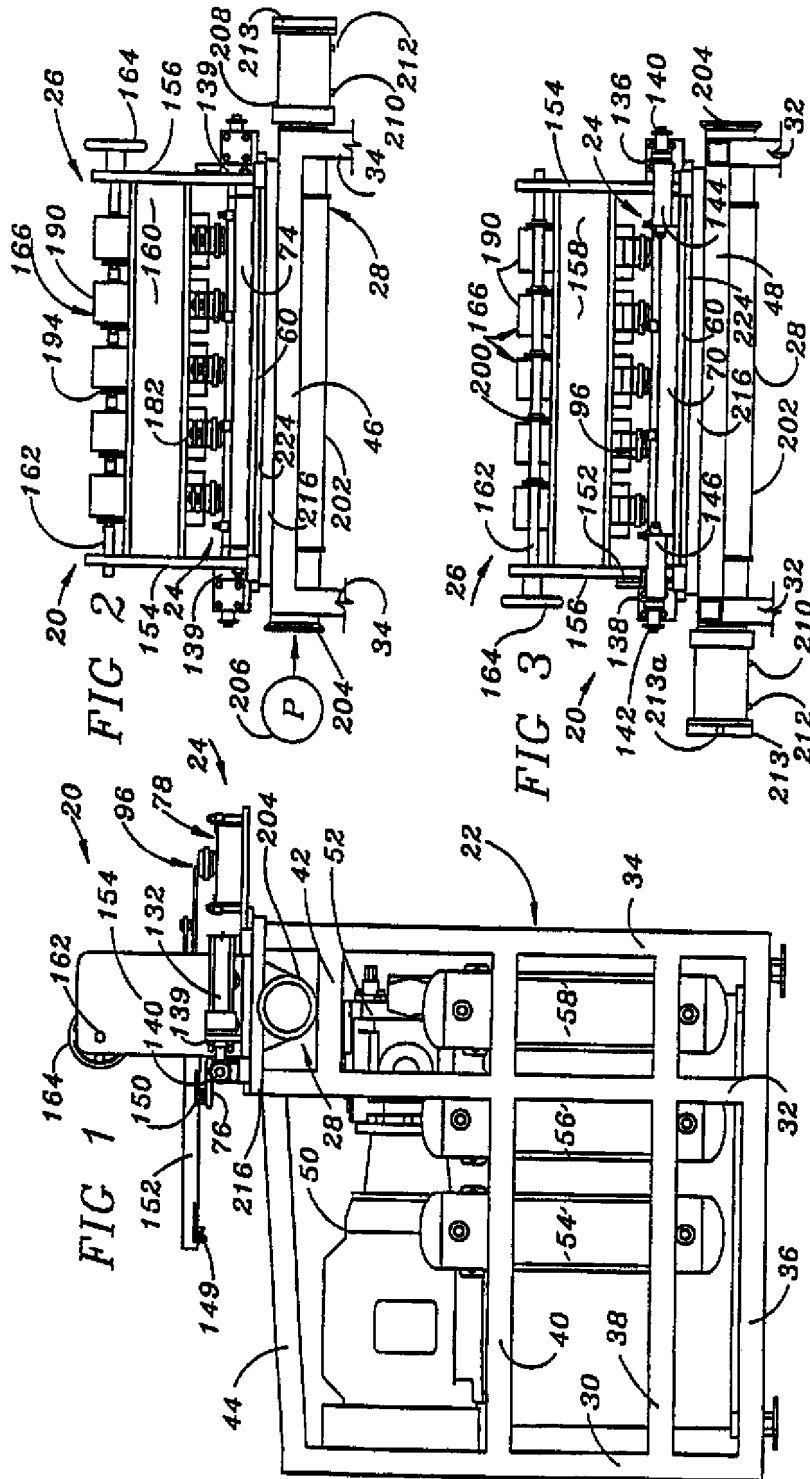
-30-

1 18. In patty forming apparatus compris-
ing a shiftable patty forming plate assembly having
structure defining a patty forming cavity therein,
means operably coupled with said assembly for deliv-
5 ery of patty forming material to said cavity for
formation of a patty therein, and means for subse-
quently ejecting a formed patty from said cavity,
improved structure for shifting movement of said
patty forming plate assembly which comprises:
10 a pair of mated hydraulic piston and cylinder
assemblies each coupled to said assembly
and each including a hydraulic cylinder,
a piston slidably received within said
15 cylinder, and a piston rod coupled to
said piston and extending outwardly from
said cylinder,
said pistons being shiftable within said
cylinders between spaced termini which
20 define the stroke length of said pistons
and piston rods; and
control means operably coupled to both of said
piston and cylinder assemblies for equal-
izing and cushioning the travel of said
25 pistons as each of the pistons approach a
corresponding termini.

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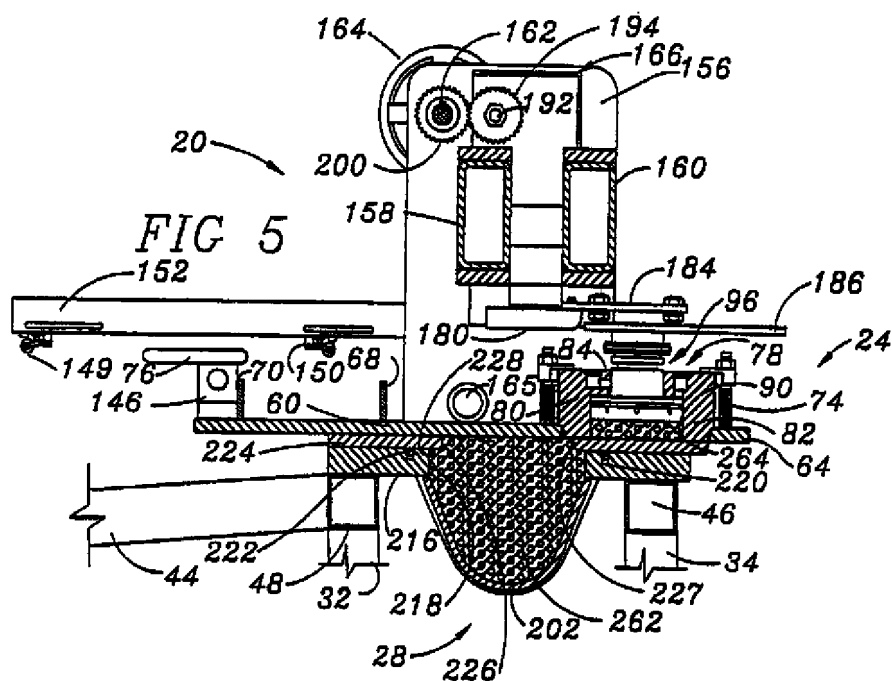
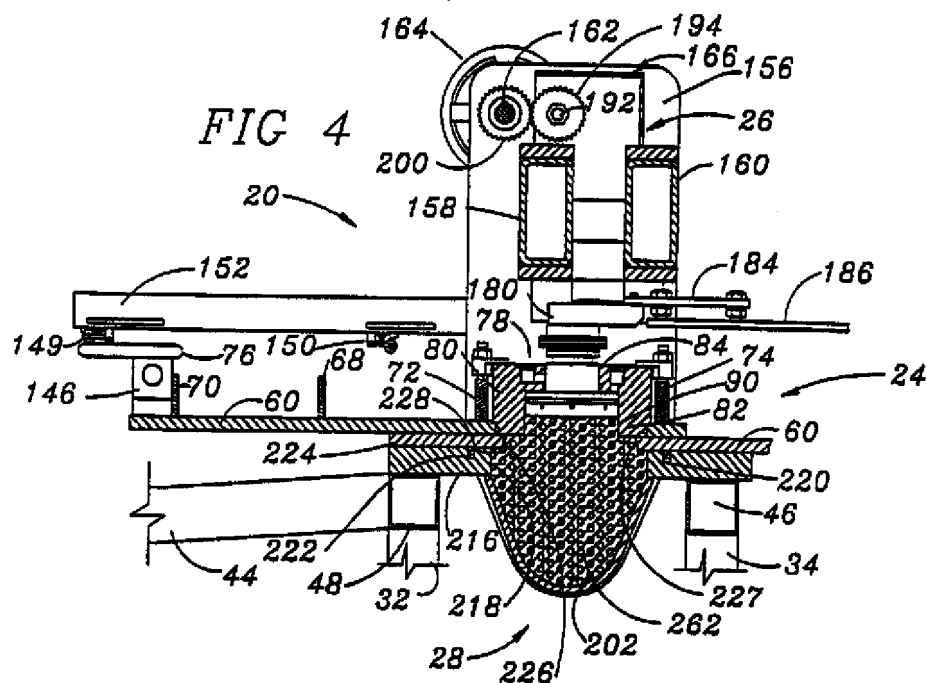
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1 of 8



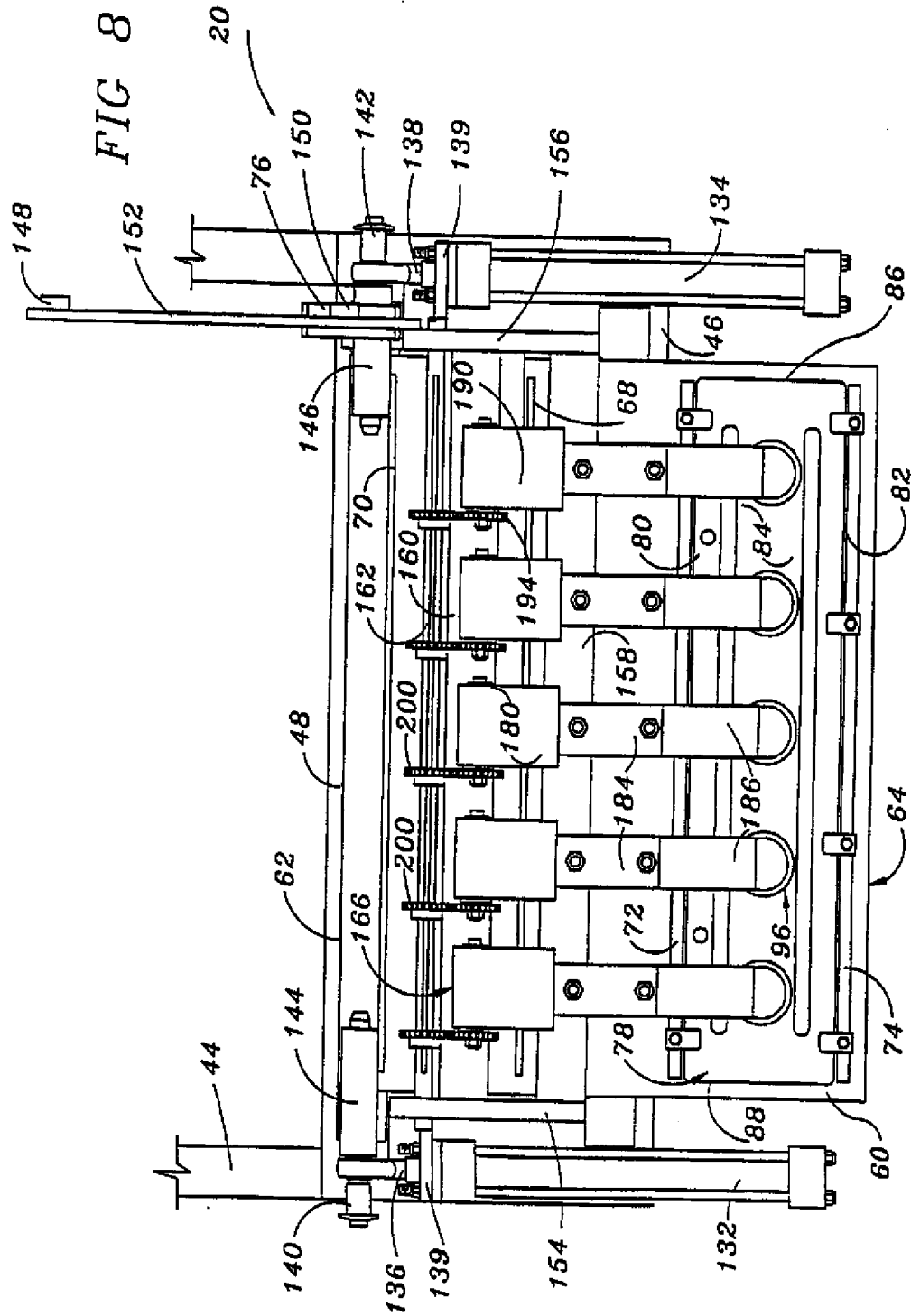
SUBSTITUTE SHEET

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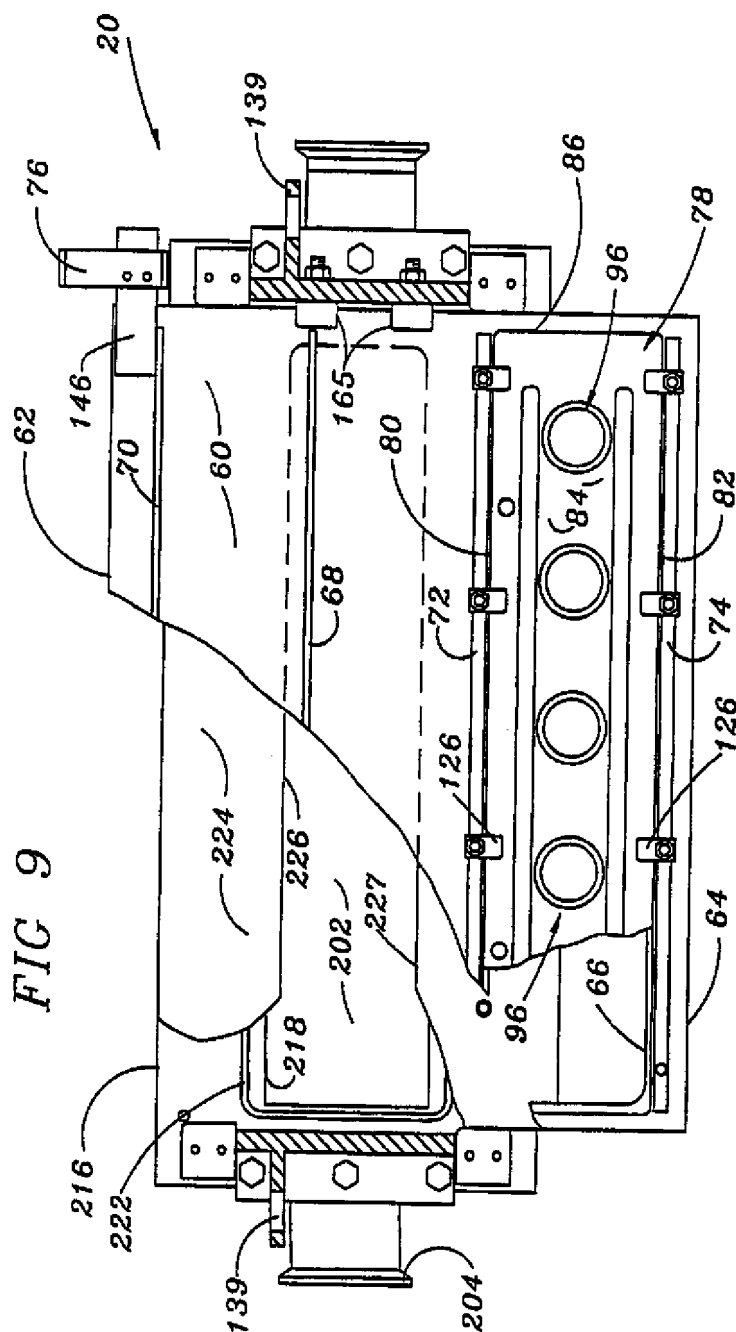


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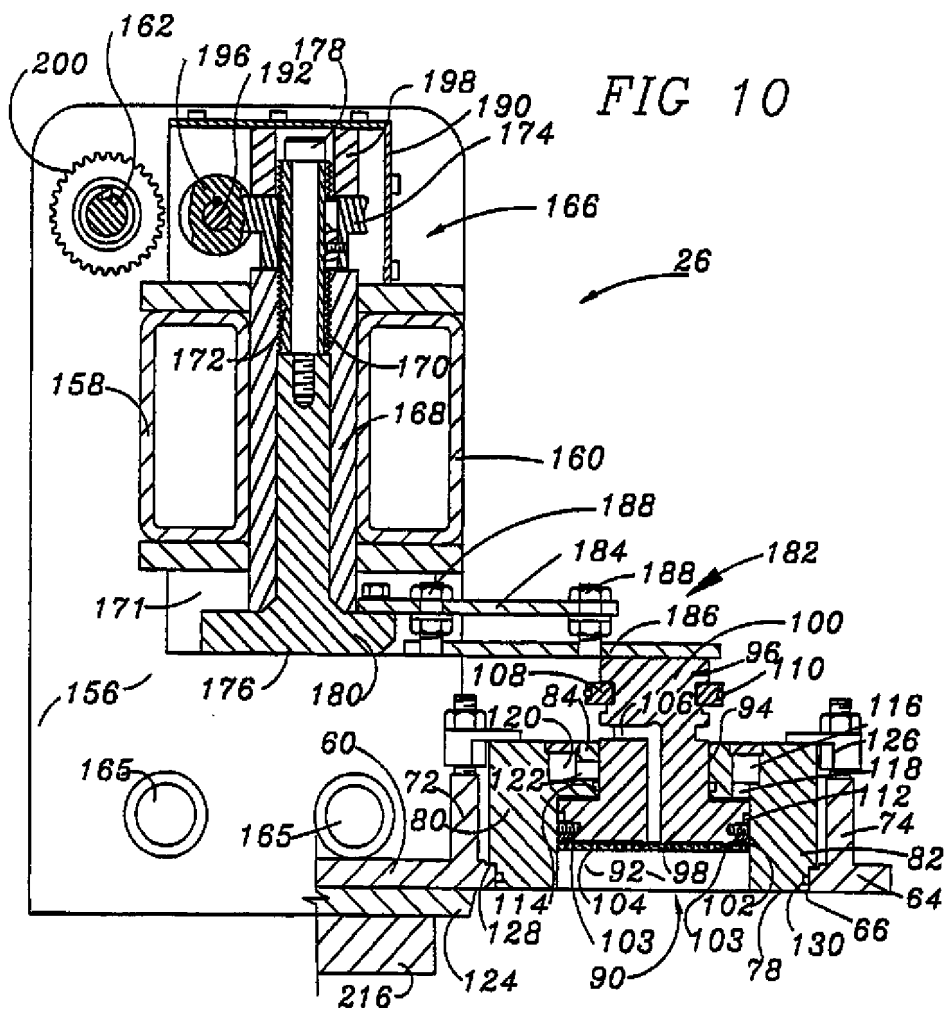
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SUBSTITUTE SHEET

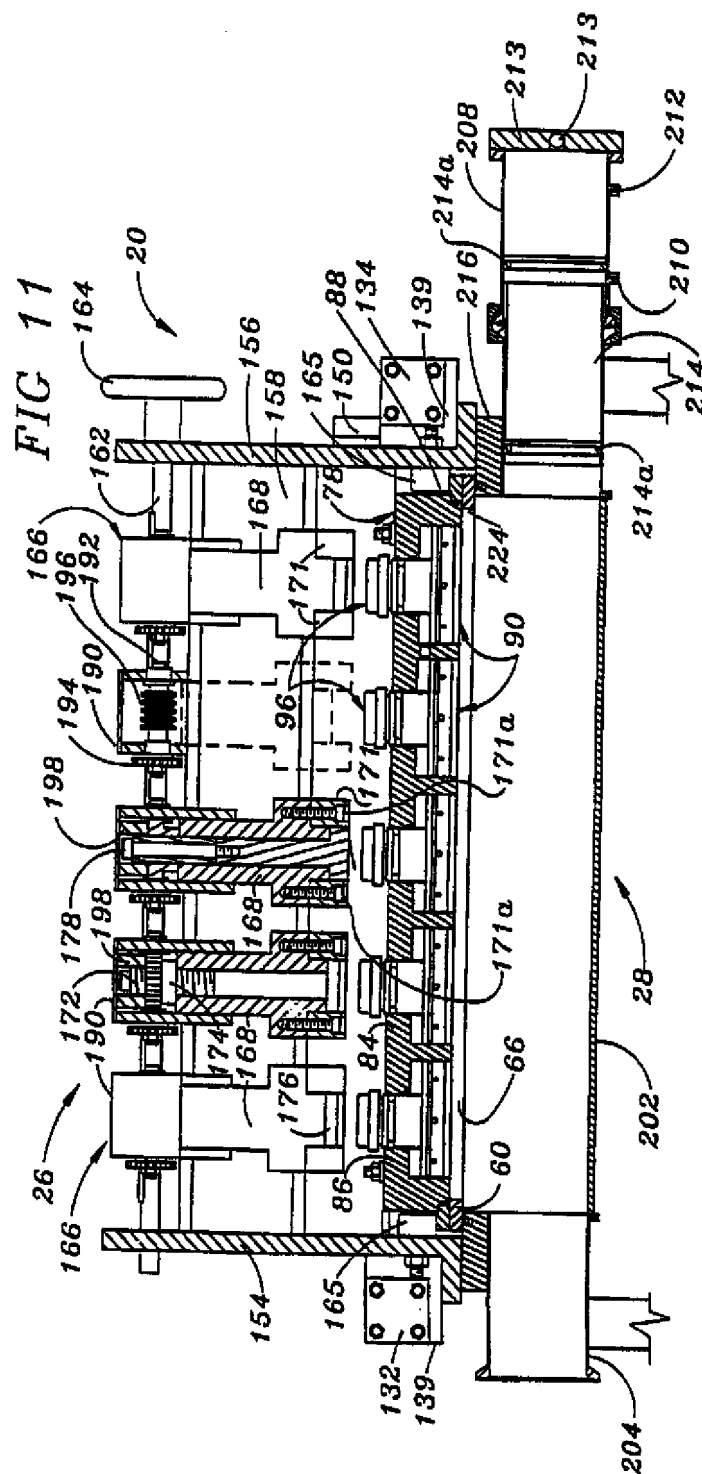


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SUBSTITUTE SHEET

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8 of 8

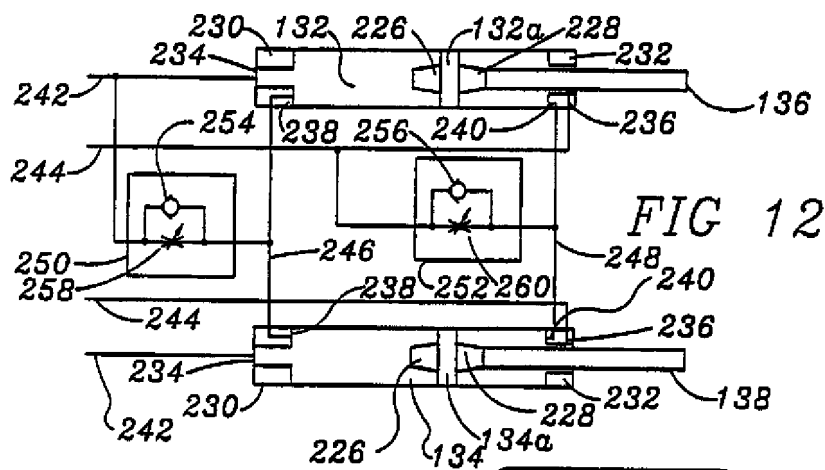


FIG 13

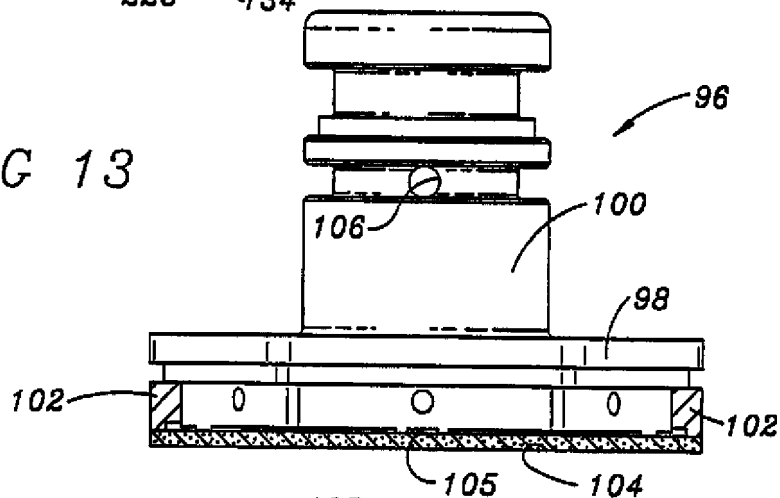
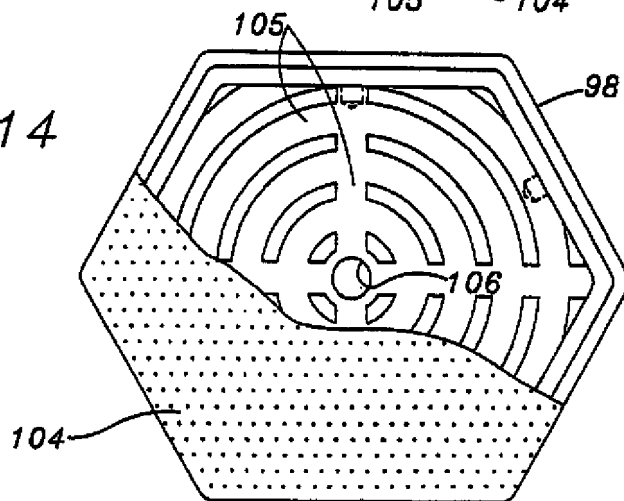


FIG 14



INTERNATIONAL SEARCH REPORT

International Application No

PCT/US90/02445

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ³

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC (5) : A22C 7/00

U.S. Cl : 17/32

II. FIELDS SEARCHED

Minimum Documentation Searched ⁴

Classification System ¹

Classification Symbols

U.S. 17/32; 425/557; 426/513

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched ⁵

III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹¹

Category ⁶	Citation of Document, ¹⁰ with indication, where appropriate, of the relevant passages ¹⁷	Relevant to Claim No. ¹⁸
A	US,A 4,043,728 (HOLLY) 23 August 1977 See Entire Document.	1-18
A	US,A 4,193,167 (ORLOWSKI ET AL) 18 March 1980 See Entire Document.	1-18
A	US,A 4,343,068 (HOLLY) 10 August 1982 See Entire Document.	1-18
A	US,A 4,697,308 (SANDBERG) 06 October 1987 See Entire Document.	1-18
A	US,A 4,768,260 (SANDBERG) 06 September 1988 See Entire Document.	1-18
A	US,A 4,821,376 (SANDBERG) 18 April 1989 See Entire Document.	1-18

(CON'T)

* Special categories of cited documents: ¹⁵

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search ⁸

20 JULY 1990

Date of Mailing of this International Search Report ⁹

23 AUG 1990

International Searching Authority ¹

ISA/US

Signature of Authorized Officer ¹⁶

WILLIS LITTLE

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

A P	US,A	4,872,241 (LINDEE) See Entire Document.	10 October 1989	1-18
A P	US,A	4,881,300 (CHIODINI) See Entire Document.	21 November 1989	1-18

V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE¹

This international search report has not been established in respect of certain claims under Article 17(2) (a) for the following reasons:

1. ☐ Claim numbers _____, because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claim numbers _____, because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out¹, specifically:

3. ☐ Claim numbers _____, because they are dependent claims not drafted in accordance with the second and third sentences of PCT Rule 6.4(a).

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING²

This international Searching Authority found multiple inventions in this international application as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.

2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:

3. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claim numbers:

4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the international Searching Authority did not invite payment of any additional fee.

Remark on Protest

☐ The additional search fees were accompanied by applicant's protest.

☐ No protest accompanied the payment of additional search fees.

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, ^{1a} with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No ¹³
A	US,A 4,872,241 (LINDEE) 10 October 1989 See Entire Document.	1-18
A	US,A 4,881,300 (CHIODINI) 21 November 1989 See Entire Document.	1-18